Pak. J. Bot., 46(5): 1703-1707, 2014.

NUTRITIONAL EVALUATION OF PLANTS OF FAMILY ZYGOPHYLLACEAE AND EUPHORBIACEAE

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Abstract

The study was conducted with the objective to find out the nutritional value of some selected plants of family Zygophyllaceae and Euphorbiaceae which are traditionally used in different parts of Pakistan. Fresh plants of *Fagonia indica* Burm. f., *Peganum harmala* L., *Tribulus terrestris* L., *Chrozophora tinctoria* (L.) Raf. and *Ricinus communis* L., were collected from Peshawar and Attock Hills during June, 2009. It was observed that the average values revealed that *P. harmala* excelled in high fat, carbohydrate, protein and moisture contents than other two species, therefore it can be considered a good nutritive plant followed by *F. indica* that contained the highest fibre. The *T. terrestris* had the maximum protein and gross energy.The differences found in the proximate composition of these medicinal plants might be attributed to the habitat, environment and time of harvest. *Chrozophora tinctoria* and *R. communis* revealed variation in various analysed biochemicals. The average values showed that *C. tinctoria* had high the moisture, ash contents, protein, fats, fibre, carbohydrate and gross energy than its counterpart *R. communis*. The cultivation of *Ricinus communis* should be encouraged on large scale for the development of biodiesel that will help people. Its seeds can be helpful for pharmaceutical, cosmetic, food and insecticidal industries.

Key words: Nutritional value, medicinal plants, Zygophyllaceae, Euphorbiaceae,

Introduction

Almost 80% of the people of marginal communities rely on medicinal plants for their health care. In Pakistan, more than 60 % people live in rural areas and use medicinal plants for curing various diseases (Hussain *et al*., 2010). Human beings require a number of complex organic matters which includes carbohydrates, fats and proteins for energy and they have dependent on plants for the above requirements (Krishnamurthy & Sarala, 2010). Verma *et al*., (2011) reported that *Ricinus communis* leaves contained ricinine, quercetin, protein, fat, carbohydrate, fiber and ash. Others determined nutritive value of some medicinal plants viz. *Amaranthus viridis* and *Urtica dioica*, *Punica granatum, Pistacia vera, Mentha sylvestris, Cassia angustifolia, Ajuga bracteosa, Hypericum perforatum, Allium sativum, Zingiber officinale* and *Valeriana officinalis* (Ahmed & Javed, 2007; Ahmed & Chaudhary, 2009 and Hussain *et al*., 2009).

Fagonia indica is annual to biennial to glabrous shrublet and *Peganum harmala* is a perennial herb while *Tribulus terrestris* is an annual or biennial, herb belonging to the family Zygophyllaceae (Shad *et al*., 2002; and Shah *et al*., 2006). *Chrozophora tinctoria* is an annual herb. *Ricinus communis* is an erect, single-stemmed or much-branched shrubby or tree like somewhat glaucous herb belonging to the family Euphorbiaceae (Kensa & Yasmin, 2011). As various medicinal plant species are also used as food along with their medicinal benefits, evaluating their nutritional significance can help to understand the worth of these plants species (Hussain *et al*., 2011). Little information is available on the nutritional value of *F. indica, P. harmala, T. terrestris, C. tinctoria* and *R. communis*. It was therefore, considered important to undertake a thorough investigation of the nutritional value of five plants species collected in summer, 2009.

Materials and Methods

Collection of plant samples: The plant parts (roots, stem, leaves and fruits) were collected from Peshawar and Attock Hills during June, 2009. The plants parts were collected at flowering and fruiting stage during summer. The plant parts were air-dried for 10 days and were powdered in electric grinder and stored in airtight bottles before analysis. They were used for the determination of nutritive value. Each specimen was given voucher number and deposited in the Herbarium of Botany Department, University of Peshawar, for future reference.

Proximate analysis: Ten g of the powdered sample was processed for various parameters and A.O.A.C (2000) methods were used to find out the proximate composition of the samples for crude proteins, crude fiber, crude fat or ether extracts, ash, moisture, carbohydrate. Ash and moisture were determined following the method of (Haro *et al*., 1968; Boussama *et al*., 1999). The proteins were determined using micro Kjeldahl method involving digestions, distillation and finally titration of the sample (Pearson, 1976). The lipid content was determined using Soxhlet type of the direct solvent extraction method. The solvent used was petroleum ether (B.P 40-60ºC) (Folch *et al*., 1957). The crude fibre was determined following (Boussama *et al*., 1999). The total carbohydrates were determined by difference method [100 - (proteins + fats + moisture + ash in percentage)] (Muller & Tobin, 1980).

The formula used for gross energy is as follows:

GE (Kcal/g) = 5.72 x (protein) + 9.5 (fat) + 4.79 (fiber) + 4.03 (carbohydrate) = Gross Energy Value. Garrett & Johnson (1983).

Results and Discussion

The presence of moisture in a crude drug can lead to its deterioration due to either activation of certain enzymes or growth of microbes. Thus moisture contents should be maintained to a reasonable level during storage. In the present study it was observed that the moisture contents were higher (9.1%) in the stems and lowest (7.4% each) in fruits and in roots of *Fagonia indica* **(**Table 1). Hussain *et al*., (2009) observed similar moisture contents in *Rumex hastatus* and *Vitis venifera*. The moisture content was highest (10.7%) in stems and lowest (7.3%) in roots of *Peganum harmala* (Table 2). The results disagree with Shad *et al.,* (2002) who reported increased moisture contents in shoots and in roots of *Fagonia arabica*. The moisture content was highest (8.8%) in leaves and lowest (6.4%) in fruits of *Tribulus terristris* (Table 3). The moisture content was highest (8.9%) in leaves and lowest (5.7%) in roots of *Chrozophora tinctoria* while it was highest (7.9%) in roots and lowest (7.1%) in stem of *Ricinus communis* (Tables 4, 5). The mean value of moisture content varied from 7.35% (*Ricinus communis*) to 9.22% (*Peganum harmala*) (Tables 2, 5).

The total ash content is a measure of the presence of inorganic compounds in a drug (Mammen *et al*., 2010). Ash was highest (16.5%) in leaves and lowest (6.7%) in roots of *Fagonia indica* (Table 1). It was highest (15.1%) in leaves and lowest (6.5%) in roots of *Peganum harmala* (Table 2). Ash contents were high (14.1%) in leaves and low (5.3%) in roots of *Tribulus terrestris* (Table 3). The results agree with Hassan & Umar (2006) who also reported high ash in the leaves of *Momordica balsamina.* Ash was highest (15.6%) in stem and lowest (8.1%) in roots of *Chrozophora tinctoria*. It was highest (21.1%) in stem and lowest (6.2%) in fruits of *Ricinus communis* **(**Tables 4, 5). The mean value of total ash content varied from 10.4% (*Tribulus terrestris*) to 13.5% (*Chrozophora tinctoria*) (Tables 3, 4). Mammen *et al*., (2010) reported higher ash contents for *Leptadenia reticulata* in summer.

The protein was highest (10.2%) in fruits and lowest (8.6%) in stems of *Fagonia indica* (Table 1). It was highest (13.3%) in fruits and lowest (8.0%) in roots of *Peganum harmala* (Table 2). It was highest (15.3%) in leaves and lowest (9.5%) in roots of *Tribulus terrestris* (Table 3). The protein (20.0%) was maximum in leaves and minimum (5.2 %) in roots of *Chrozophora tinctoria.* Protein (24.9%) was highest in leaves and lowest (2.6%) in fruits of *Ricinus communis* (Tables 4, 5). The mean value of protein content varied from 9.45% (*Fagonia indica*) to 12.5% (*Tribulus terrestris*) (Tables 1, 3). Bukhsh *et al*., (2007) reported that crude proteins varied with plant parts thus supporting the present results. Hussain *et al*., (2009) also reported high protein content in *Terminalia chebula, Pistacia vera*, and *Coriandrun sativum*. In the present investigation the plants parts (roots, stem, leaves and fruits) were collected from Peshawar and Attock Hills during June, 2009 and were collected at flowering and fruiting stage during summer.

Table 1. Proximate composition of *Fagonia indica* L., during summer.

Voucher specimen collector, number, herbarium	Parts	Moisture contents (%)	Ash contents %)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross energy (Kcal/g)
Ghulam Dastagir Bot. 20068, (PUP) *Fagonia indica*	Roots	7.4	6.7	9.0	3.7	62.3	10.9	428.9
	Stems	9.1	11.9	8.6	4.9	54.3	11.2	400.8
	Leaves	8.4	16.5	10.0	8.9	41.3	14.9	399.5
	Fruits	7.4	10.7	10.2	6.2	55.2	10.3	423.1
	Mean	**8.07**	**11.45**	**9.45**	**5.9**	**53.27**	**11.8**	**413.0**

Table 2. Proximate composition of *Peganum harmala* L. during summer.

Voucher specimen collector, number, herbarium	Parts	Moisture contents (%)	Ash contents %)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross energy (Kcal/g)
Ghulam Dastagir Bot. 20069, (PUP) *Peganum harmala*	Roots	7.3	6.5	8.0	3.2	60.2	14.8	424.1
	Stems	10.7	10.4	11.6	8.7	33.4	25.2	410.5
	Leaves	9.6	15.1	11.5	7.8	22.3	33.7	382.4
	Fruits	9.3	10.0	13.3	11.6	34.0	21.8	438.1
	Mean	**9.22**	**10.5**	**11.1**	**7.8**	**37.5**	**23.8**	**413.7**

Table 3. Proximate composition of *Tribulus terrestris* L. during summer.

Voucher specimen collector, number, herbarium	Parts	Moisture contents (%)	Ash contents %)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross energy (Kcal/g)
Ghulam Dastagir, Bot. 20070, (PUP) *Tribulus terrestris*.	Roots	7.5	5.3	9.5	2.1	52.1	23.5	418.2
	Stems	7.7	11.3	11.1	8.4	57.4	4.1	434.2
	Leaves	8.8	14.1	15.3	8.9	42.3	10.6	423.0
	Fruits	6.4	10.9	14.2	9.3	52.6	6.6	448.1
	Mean	**7.6**	**10.4**	**12.5**	**7.1**	**51.1**	**11.2**	**430.8**

Table 4. Proximate composition of *Chrozophora tinctoria* (L.) Raf during summer.

Voucher specimen collector, number, herbarium	Parts	Moisture contents (%)	Ash contents %)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross energy (Kcal/g)
Ghulam Dastagir Bot.20071, (PUP) *Chrozophora tinctoria*	Roots	5.7	8.1	5.2	6.9	10.3	63.8	401.6
	Stems	7.8	15.6	9.7	8.0	51.1	7.8	407.1
	Leaves	8.9	15.1	20.0	9.8	56.3	0.0	436.4
	Fruits	8.4	15.5	13.8	11.0	53.7	0.0	431.0
	Mean	**7.7**	**13.5**	**12.1**	**8.9**	**42.9**	**35.8**	**419.0**

Table 5. Proximate composition of *Ricinus communis* L., during summer.

Voucher specimen collector, number, herbarium	Parts	Moisture contents (%)	Ash contents %)	Protein contents (%)	Fat contents (%)	Fibre contents (%)	Carbohydrate (%)	Gross energy (Kcal/g)
Ghulam Dastagir Bot.20072, (PUP) *Ricinus communis*	Roots	7.9	19.3	9.6	5.9	57.0	0.3	385.0
	Stems	7.1	12.1	7.7	6.8	52.6	13.7	416.1
	Leaves	7.2	11.8	24.9	11.8	11.3	33.0	441.5
	Fruits	7.2	6.2	2.6	6.2	22.5	55.3	404.2
	Mean	**7.35**	**12.35**	**11.2**	**7.67**	**35.9**	**25.57**	**411.7**

The fat content was highest (8.9%) in leaves and lowest (3.7%) in roots of *Fagonia indica* (Table 1). The results agreed with Hussain *et al*., (2009) who also reported higher fat contents in *Fumaria officinalis*. The fat was highest (11.6%) in fruits and lowest (3.2%) in roots of *Peganum harmala* (Table 2). It was highest (9.3%) in fruits and lowest (2.1%) in roots of *Tribulus terrestris* (Table 3). It was highest (11.0%) in fruits and lowest (6.9%) in roots of *Chrozophora tinctoria*. It was also highest (11.8%) in leaves and lowest (5.9%) in roots of *Ricinus communis* (Tables 4, 5). The mean value of fat content ranged from 5.9% (*Fagonia indica*) to 8.9% (*Chrozophora tinctoria*) (Tables 1, 4). Ahmad & Javed (2007) reported less fat content in *Amaranthus viridis* and *Urtica dioica* as compared to the present study.

The importance of fiber in diet cannot be neglected as it decreases serum cholesterol levels, risk of coronary heart diseases, hypertension, diabetes and breast cancer (Ishida *et al*., 2000). The fibre was highest (62.3%) in roots and lowest (41.3%) in leaves of *Fagonia indica* in the present study (Table 1). Shad *et al.,* (2002) also reported maximum fibre contents in the roots of *Fagonia arabica* followed by shoots and whole plant. The possible reason could be that the function of roots is to anchor the plant in the soil firmly, for which it needs more fibre for strength. It was highest (60.2%) in roots and lowest (22.3%) in leaves of *Peganum harmala* (Table 2). It was highest (57.4%) in stems and lowest (42.3%) in leaves of *Tribulus terrestris* (Table 3). It was highest (56.3%) in leaves and lowest (10.3%) in roots of *Chrozophora tinctoria* while the fibre content was highest (57.0%) in roots and lowest (11.3%) in leaves of *Ricinus communis* (Tables 4, 5). The mean value of fibre content varied from 35.9% (*Ricinus communis*) to 53.27% (*Fagonia indica*) (Tables 1, 5).

Carbohydrates are essential for the maintenance of plant life and also provide raw materials for many industries (Oladele & Oshodi, 2007). Carbohydrates were highest (14.9%) in leaves and lowest (10.3%) in fruits of *Fagonia indica* (Table 1). Rajkala *et al*., (2011) also reported carbohydrates in fruit of *Tribulus terrestris* and it agreed with the present study. Carbohydrates (33.7%) were highest in leaves and lowest (14.8%) in roots of *Peganum harmala* **(**Table 2). This agrees with Iniaghe *et al*., (2009) and Hussain *et al*., (2009) who reported high carbohydrate contents in leaves of *Acalypha*, *Terminalia belerica* and *Ziziphus vulgaris*. It was highest (23.5%) in roots and lowest (4.1%) in stems of *Tribulus terrestris* (Table 3). It was also highest (63.8%) in roots and not found in the leaves and fruits of *Chrozophora tinctoria*. It was highest (55.3%) in fruits and lowest (0.3%) in roots of *Ricinus communis* **(**Tables 4, 5). The mean value of carbohydrate content varied from 11.2% (*Tribulus terrestris*) to 35.8% (*Chrozophora tinctoria*) (Tables 3, 4).

All carbon containing compounds have a certain amount of energy which are a primary source of medicines, fibre, food, and other items in daily use by humans (Hemingway, 2004). The gross energy was highest (428.9 Kcal/g) in roots and lowest (399.5 Kcal/g) in leaves of *Fagonia indica* (Table 1). It was highest (438.1 Kcal/g) in fruits and lowest (382.4 Kcal/g) in leaves of *Peganum harmala* (Table 2). It was highest (448.1 Kcal/g) in fruits and lowest (418. 2 Kcal/g) in roots of *Tribulus terrestris* (Table 3). It was highest (436.4 Kcal/g) in leaves and lowest (401.6 Kcal/g) in roots of *Chrozophora tinctoria* while it was highest (441.5 Kcal/g) in leaves and lowest (385.0 Kcal/g) in roots of *Ricinus communis* (Tables 4, 5). The mean value of gross energy varied from 411.7Kcal/g (*Ricinus communis*) to 430.8Kcal/g (*Tribulus terrestris*) (Tables 3, 5). Dongmeza *et al*., (2009) reported significant changes in

gross energy in *Musa nana* and *Manihot esculenta* leaves collected in summer and this agrees with the present results. Akubugwo *et al.,* (2007) reported 268.92 Kcal/ g gross energy in *Amaranthus hybridus*.

Fagonia indica L., occurs in dry habitats throughout Pakistan and is known as Azghakhi & Dhaman in Khyber Pakhtunkhwa. It is used in piles, urinary disorders, fever, dysentery, asthma, liver, typhoid, skin diseases, and cancer (Marwat *et al.,* 2008; Akhtar & Begum, 2009).

Peganum harmala L. is called Harmal (Saraiki) and Spalani (Pashto) and is used for healing wounds, inflammed body parts, in diarrhea and indigestion (Marwat, *et al.,* 2008). *Peganum harmala* seeds are antiseptic, used in asthma, paralysis, gastrointestinal, epilepsy, menstrual problems, anthelmintic especially for tape worms, hemorrhoids and baldness. It is brain tonic and used along with olive oil for ear problems (Shah & Khan, 2006). *Tribulus terrestris* is known as Bhakra, Gokhru and its fruits are used in urinary bladder, leaves in colic and chronic cough (Marwat *et al.*, 2008).

Chrozophora tinctoria is known as dyers-croton and is effective as emetic, cathartic and used in fever (Delazar *et al*., 2006). *Ricinus communis* L. is called Arand (Punjabi, Urdu) and is used in constipation before and after child birth to mother (Qureshi *et al.,* 2009). The oil and seeds are used for warts, cold tumors, corns and moles. Castor-oil is a cathartic and it softens and lubricates the skin. A branded gel Gastro oil is used against dermatitis and protective in occupational eczema and dermatitis. The oil is used in foams and creams (Rizvi, 2007).

In comparative assessment of the different plant species, it was observed that the average values revealed that *Peganum harmala* excelled in high fat, carbohydrate, protein and moisture contents than other two species, therefore it can be considered a good nutritive plant followed by *Fagonia indica* that contained the highest fibre. The *Tribulus terrestris* had the maximum protein and gross energy (Tables 1, 2, 3).

Among the analysed Euphorbiaceae plants *Chrozophora tinctoria* and *Ricinus communis* also had variation in various analysed biochemicals (Tables 4, 5). The average values indicated that *Chrozophora tinctoria* had high the moisture contents, ash contents, protein, fats, fibre, carbohydrate and gross energy than its counterpart *Ricinus communis* (Tables 4, 5). The differences found in the proportion of proximate parameters of these medicinal plants might be attributed to the habitat, environment and time of harvest (Hussain *et al*., 2009).

The present study suggests that the various analysed parameters such as ash values and moisture contents showed variation due to parts analysed and region of collection. These values however, can help in judging the best time and place of collection for a particular plant. It is suggested that similar studies need to be carried out for other medicinal plants for these and other chemical parameters.

Conclusions

It is then concluded that the investigated plants need to be cultivated on large scale as they are being used traditionally for the treatment of different diseases as little attention has been given so far to these plants. Our present study on nutritional evaluation of *Fagonia indica*, *Peganum harmala*, *Tribulus terrestris*, *Chrozophora tinctoria* and *Ricinus communis* are source of proteins, fats, carbohydrates, fiber and can be used as substrates deficit in either of these nutrients.

Acknowledgement

The research grant by the University of Peshawar to Ghulam Dastagir Ph.D. scholar is gratefully acknowledged. This paper is a part of Ph.D. research work.

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(Received for publication 8 December 2012)